CLAIMS

What is claimed is:

1. A damper for absorbing vibration transmitted from an un-sprung mass to a sprung mass on a vehicle, the damper comprising:

an outer cylinder;

an inner cylinder disposed inside the outer cylinder, a space between the inner cylinder and the outer cylinder defining a reserve chamber;

a valve slidingly engaging an inner wall of the inner cylinder;

a rod attached to the valve and extending along an axis of the outer cylinder and the inner cylinder; and

an adjustable valve positioned inside the outer cylinder, the adjustable valve fluidly connecting the upper working chamber and the lower working chamber with the reserve chamber, the adjustable valve portion providing a variable flow resistance to fluid flowing between the upper working chamber and the reserve chamber responsive to an external signal.

2. The damper as claimed in Claim 1, wherein the adjustable valve has a cylindrical outer surface that is axially aligned with the inner cylinder and the outer cylinder.

3. The damper is claimed in Claim 1, wherein the inner cylinder comprises a first inner cylinder and a second inner cylinder, the first inner cylinder positioned inside and spaced from the second inner cylinder to form a gap, connects the upper working chamber being in communication with the gap, the gap fluidly communicating with the adjustable valve portion to fluidly communicate with the reserve chamber through the adjustable valve portion.

4. The damper as claimed in Claim 1, further comprising a lower support positioned within and supported by the outer tube, the lower support having an aperture therein to support the adjustable valve portion.

5. The damper as claimed in Claim 4, further comprising a valve entrance area fluidly connected to a valve entrance of the adjustable valve portion and fluidly connected to the upper working chamber, the valve entrance area passing through the lower support.

6. The damper as claimed in Claim 4, wherein the lower support further comprises a passage that connects a valve exit of the adjustable valve portion with the reserve chamber.

7. A damper for absorbing vibrations between a sprung mass and an un-sprung mass of a vehicle, the damper comprising:

an outer cylinder;

an inner cylinder positioned inside of and coaxially aligned with the outer cylinder, a space between the inner cylinder and the outer cylinder defining a reserve chamber;

an upper rod guide positioned at a first end of the inner tube and a first end of the outer tube;

a rod slidingly engaged with the rod guide, a portion of the rod positioned inside the inner cylinder, a first end of the rod extending to a location external to the upper rod guide;

a valve attached to a second end of the rod, the valve in sliding engagement with an inside wall of the inner cylinder, an area inside the inner cylinder between the valve and the upper rod guide defining an upper working chamber, an area inside the inner cylinder on a side of the valve distally located from the upper rod guide being defined as a lower working chamber;

a down tube extending through the reserve chamber, a first end of the down tube being connected to the upper working chamber;

an adjustable valve portion; and

a lower support positioned and supported by an inner wall of the outer cylinder, the lower support having an aperture that supports the adjustable valve, the lower support having a valve entrance area that fluidly connects a second end of the down tube to a valve entrance area of the adjustable valve portion, the lower support having a passage that connects a valve exit of the adjustable valve portion to the reserve chamber, the adjustable valve portion providing a variable flow resistance to fluid flowing between the upper working chamber and the reserve chamber responsive to an external signal.

8. The damper as claimed in Claim 7, wherein the adjustable valve portion is positioned inside the outer cylinder.

9. The damper as claimed in Claim 8, wherein the adjustable valve portion is cylindrical, the adjustable valve portion being coaxial with the inner cylinder and the outer cylinder.

10. A damper for absorbing vibrations between a sprung mass and an un-sprung mass of a vehicle, the damper comprising:

an outer cylinder;

a first inner cylinder positioned inside of and coaxial with the outer cylinder;

a second inner cylinder positioned inside the outer cylinder and outside the first inner cylinder, a space between the first inner cylinder and the second inner cylinder defining a gap;

an upper rod guide positioned at first ends of the outer cylinder, first inner cylinder, and second inner cylinder;

a rod slidingly engaged with a bore of the upper rod guide, a first end of the rod extending to a location external to the first inner cylinder, a second end of the rod being inside the first inner cylinder;

a valve attached to the second end of the rod, the valve being in sliding engagement with an inner wall of the first inner cylinder, an area inside the first inner cylinder between the upper rod guide and the valve defining an upper working chamber, an area on a side of the valve inside the first inner cylinder distally located from the upper rod guide defining a lower working chamber, the upper working chamber fluidly communicating with the gap;

an area between the second inner cylinder and the outer cylinder defining a reserve chamber;

an adjustable valve portion fluidly communicating between the gap and the reserve chamber, the adjustable valve portion providing a variable flow

resistance to fluid flowing between the upper working chamber and the reserve chamber responsive to an external signal; and

a lower support engaged with an inner wall of the outer cylinder, the lower support having an aperture that supports the adjustable valve portion, the lower support having a valve entrance area that fluidly communicates between the gap and the adjustable valve portion, a passage that communicates between a valve exit of the adjustable valve portion and the reserve chamber.

11. The damper as claimed in Claim 10, wherein the adjustable valve portion is cylindrically shaped, the adjustable valve portion being coaxial with the first inner cylinder, second inner cylinder and the outer cylinder.

12. The damper as claimed in Claim 11, wherein the adjustable valve portion is positioned inside the outer cylinder.

13. A vehicle comprising:

a sprung mass;

an un-sprung mass;

a damper connecting the sprung mass to the un-sprung mass, the damper absorbing vibrations between the sprung mass and the un-sprung mass, the damper further including:

an outer cylinder;

an inner cylinder positioned inside the outer cylinder, an area between the inner cylinder and the outer cylinder defining a reserve chamber;

a rod guide supporting first ends of the inner cylinder and the outer cylinder;

a rod slidingly engaged with the rod guide, a first portion of the rod extending external to the inner cylinder and a second portion of the rod extending inside the inner cylinder;

a valve attached to the second portion of the rod, the valve slidingly engaged with an inner wall of the inner cylinder, an area inside the inner cylinder between the valve and the rod guide defining an upper working chamber, an area on a side of the valve distal from the rod guide and inside the inner cylinder defining a lower working chamber;

an adjustable valve portion;

a lower support engaged with an inside wall of the outer cylinder, the lower support having an aperture that supports the adjustable valve

portion, the adjustable valve portion fluidly communicating the upper working chamber with the reserve chamber, the adjustable valve portion providing a variable flow resistance to fluid flowing between the upper working chamber and the reserve chamber responsive to an external signal.

14. The vehicle as claimed in Claim 13, wherein the damper is coaxial with the inner cylinder and the outer cylinder.

15. The damper as claimed in Claim 14, wherein the adjustable valve portion is positioned inside the outer cylinder.

16. A damper for absorbing vibration transmitted between a sprung mass and an un-sprung mass of a vehicle, the damper comprising:

a cylindrical outer housing containing a first fluid chamber and a second fluid chamber, the first fluid chamber being coaxially aligned with the second fluid chamber; and

an adjustable valve portion connecting the first fluid chamber with the second fluid chamber, the adjustable valve portion providing a variable flow resistance between the first fluid chamber and the second fluid chamber responsive to an external signal, the adjustable valve portion having a cylindrical outer surface axially aligned with the first fluid chamber and the second fluid chamber.